Agroforestry Systems **59:** 73–83, 2003.

Agroforestry potential in the southeastern United States: perceptions of landowners and extension professionals

Sarah W. Workman*, Michael E. Bannister and P.K.R. Nair
*Center for Subtropical Agroforestry, School of Forest Resources and Conservation, University of Florida, Gainesville, FL 32611 USA; *Author for correspondence (tel.: (352) 846 3496; fax: (352) 846 2094; e-mail: sworkman@ufl.edu)*

Key words: Farmland management, Land use, Non-industrial forestry, Subtropical

Abstract

The first steps in developing an agroforestry extension and training program involve compilation, synthesis, and analysis of current knowledge on existing practices. Equally important is to understand the perceptions of landowners and professionals of agroforestry as a land use option. No systematic effort has been made to assess these critical issues in the southeastern United States. Therefore, needs assessment surveys were developed following an analysis of major demographic issues that frame land use in the region and synthesis of information obtained from informal site visits and interviews with people engaged in resource and land use in the Atlantic and Gulf Coastal Plain. Surveys of extension professionals and landowners were then undertaken in the states of Alabama, Florida, and Georgia to represent the southeastern region. In addition to getting insights into the perceived benefits and concerns about agroforestry practices, the surveys indicated that the extent of alley cropping, forest farming and silvopasture practiced by landowners was less than anticipated, and that the prominence of windbreaks was overlooked by professionals. Managed riparian forest buffers or streamside management zones and windbreak technologies were the most widely used forms of agroforestry in the study area, although landowners did not recognize influence of agroforestry practices on quality or quantity of water among benefits of highest importance to them. Multistrata patio- or home gardens were also a prominent landowner-practice and acknowledged by professionals. These survey results can be useful for developing a relevant agroforestry extension and training program in the subtropical Southeast and may be of interest to agroforestry efforts in other similar settings.

Introduction

The Coastal Plain physiographic region of the southern United States from Virginia through Texas contains 30% of the national land area and 42% of the country's farms (NASS 2001). Across10 southeastern states from North Carolina to Louisiana, 57% of the rural non-federal land is in forest, 22% in cropland, and 14% in pasture. During the five-year period from 1982 to 1987, more than 800,000 ha (2 mil ac) of pasture and cropland were converted to development in these ten states (Bliss 1991). Most of the observed increase in urban land use development in the region between 1982 and 1997 has been concentrated in the five coastal states from Virginia to Florida (USFS 2001). The urbanization of rural areas, increasing land values at the urban/rural interface, and transitions in land uses are pressures influencing land use activities, especially agriculture, in the southeastern USA.

Forestlands in the Southeast have been exploited for more than 300 years. Much of the forest area under private ownership, which is important for wildlife habitat and influence on hydrologic regimes, is not under active management (USFS 2001). The current area of approximately 87 million ha (214 mil ac) of forestland across 13 southern states from Virginia to Texas represents about 60% of the area of pre-co-

lonial forest cover in 1630. Forest industry owns less than one fourth of the total forested area in the Southeast and about one tenth is publicly owned. The rest, or about two thirds of the timberland in the region, is owned by private non-industrial owners (Bliss 1991; Wear and Greis 2002). For example, in Alabama 22% of the forestland is owned by forest industry and they lease an additional 3%. This leaves 70% of forestland in the hands of other private owners (USFS 2001) in Alabama. In Florida, forests cover 47% of the total land area, or about 6.5 million ha (16 mil ac). Private non-industrial landowners own 46% of this forestland. These ownership patterns reflect social and economic factors of education, financial resources, total area owned, and inheritance (Birch et al. 1982). Neglect and poor management of private forested lands are all too common, although there is an increasing awareness among landowners about management benefits, an increasing number of forestry consultants to help provide information and services, and promising government incentive programs to foster farm security and rural investment.

Intensification and diversification of farming systems are seen as ways to maintain production, enhance rural livelihoods, and optimize use of areas remaining in agriculture. With growing interest in agroforestry worldwide, combined systems involving tree-crop and tree-forage combinations have been suggested as more efficient and economical than those practiced today on marginal crop and pasturelands in the southeast (Zinkhan and Mercer 1997; Clason and Sharrow 2000; AFTA 2000). Constraints to adoption of agroforestry practices identified by the natural resource professionals in southern US, as identified by Zinkhan and Mercer (1997), included: farmers' need for technical knowledge and their lack of management skills for practices, incompatibility between multiple outputs, high establishment or annual management costs, and negative impacts of livestock on tree seedlings and soil productivity. The potential for harboring weedy species and negative pest interactions have also been noted by other researchers, though it is commonly held that species diversification in agroforestry designs can lead to improved pest management (Dix et al. 1999; Stamps et al. 2002). Other possible obstacles to use of agroforestry practices, reported in literature, are farmer inexperience with economic planning for intensity and timing of inputs and outputs, lack of institutional and policy support including finances and incentives, or inappropriate 'technology packages' (Buck 1995; Kettler, JS, pers. comm. 1995) that do not address farmer goals in a cost-effective manner (Shultz et al. 1995; Merwin 1997). AFTA, the Association for Temperate Agroforestry (2000), emphasizes that economic data and marketing strategies for products need to be included in technology transfer efforts. The value of non-market benefits or non-economic values is evident to many practitioners and motivates some to implement practices; however, valuation of these benefits is often a constraint at higher levels of institutional and social policy (Merwin 1997; Lassoie and Buck 2000). Poor market development or poor acquisition of market information by landowners, and inadequate public education (Kurtz 2000; NARC&DC 2000) are also sited as constraints to development of agroforestry.

Awareness about the role and potential of agroforestry as a viable and sustainable land use option is quite low among private landowners, foresters, agricultural extension, and other land use professionals in the United States (Williams et al. 1997; Lassoie and Buck 2000). Most extension professionals in agriculture and natural resources have had little to no opportunity for training in agroforestry. During the 1990s, interest in agroforestry was mostly concentrated in universities and had just begun to filter into public programs. Some efforts have been made to rectify this situation. For example, a few formative workshops held in the region (Kettler JS, pers. comm., 1995; Cannon PG, pers. comm., 1998) drew interested parties together and fomented action in the region; universities and the US Department of Agriculture (USDA) National Agroforestry Center and the Natural Resources Conservation Service (NRCS) have pioneered infrastructure and extension mechanisms that are specific to agroforestry in the southeast. Nevertheless, there are few extension publications and audiovisual aids dealing with agroforestry for the region (D.J. Carl, pers. comm.., 1998). The Center for Subtropical Agroforestry, CSTAF, a new multi-institutional initiative based at the University of Florida has embarked on developing agroforestry extension materials and, in collaboration with other groups, providing technical in-service training to natural resources professionals in the principles, technologies, and opportunities for agroforestry specific to the region. This paper outlines the procedures adopted and analyses the early experience gained in that effort.

Methods

A needs-assessment was seen as a critical first step in developing a relevant extension program for agroforestry. To that end, first, demographic and land use data were compiled and analyzed to understand the patterns of change during the past two decades. Then a series of surveys was developed and implemented to understand the working environment of the audience, both extension professionals and landowners, and what it will take to incorporate agroforestry designs on properties and in communities of the region. The basic information needed for formulating these opinion surveys for needs assessment were obtained from literature search, field observations, open-ended interviews with extension personnel, foresters, university faculty, and from farm visits and case studies. This initial effort was focused on working with extension professionals, foresters in state agencies, farmers and forest landowners. Alabama, Florida, and Georgia were chosen for the survey to represent the southeastern region. The geographical area sampled represents the subtropical region of the Atlantic and Gulf Coastal Plain of the southern USA: the entire state of Florida, 32 counties in Alabama, and 99 counties in Georgia.

Survey questions were developed and pre-tested with professionals and landowners in six north and northwest Florida counties following methods outlined by Dillman (2000). After pilot tests and revisions, similar but separate sets of survey questions were sent to extension professionals and landowners. Two weeks after the initial mailing a reminder postcard was sent to all recipients who had not responded to the first mail survey. One month after the initial mailing a second copy of the survey was mailed to all who had not yet responded.

All state forestry professionals, all agricultural, livestock and natural resource extension professionals, and a selection of other extension professionals (e.g., youth education, horticulture, nutrition) in each county in the sample area received the survey during June and July 2001. Of the 696 surveys originally mailed, 52 were returned undelivered. Of the completed surveys, 297 questionnaires (43%) returned by professionals in the three states were used for statistical analysis. Normally distributed means from the surveys were statistically tested with analysis of variance and ranked data analyzed with nonparametric tests (SAS v8).

The Florida and Alabama landowner surveys were mailed between January and August 2002 within a randomized selection of counties, stratified by agricultural districts, with four counties per district sampled. Counties with more than 500 inhabitants per square mile (193 / km^2) were not included in the sample. Anticipating a 25% return rate and preferred minimum of 500 surveys returned, landowners were randomly selected to represent the number of farms in the county proportional to the total number of farms in the state. Their addresses were obtained from the Florida Department of Revenue or the Alabama Farm Service Agency. Completed questionnaires were received from 200 (11%) Florida landowners, and 542 (12%) Alabama landowners; these were used for statistical analysis.

Results

Products, farm demographics, and private forestland in the region

Agriculture and forestry together comprise the single largest sector of state economy in Alabama and Georgia and the second (only to tourism) for Florida. Cash receipt rankings in the agricultural sector for the three states are (NASS, 2001):

- Alabama: poultry 38%, timber 22%, livestock 18%
- Florida: vegetables 21%, timber 20%, fruits 19%, ornamentals 16%
- Georgia: poultry 51%, field crops 21%, timber 16%, livestock 12%.

The USDA Census of Agriculture (NASS, 2001) data shows the value of all farm products sold in the three states doubled during the period from 1978 to 1997. In 1997, Florida had more than two times the overall cash receipts throughout this period (almost $ 5 billion in 1997) than Georgia ($ 2 billion), and Georgia had more than two times that of Alabama (Table 1). The opposite is true for receipts from poultry and livestock where Georgia ($ 3.1 billion) and Alabama ($ 2.4 billion) values were more than two times that of Florida. Florida still has the largest share of (30%) of its land area in farms compared with Georgia (28%) and Alabama (26%), but it has also lost the most farmland (20%) as a percent of the total area (Table 1).

Farm size (all ownership classes) varies among the three states (Figure 1). The number of farms with

Table 1. Farm management statistics (1997 data) and estimates of changes in some of these factors in three southeastern states (Alabama, Florida, and Georgia) of the USA. Source: NASS (2001)

	Alabama	Florida	Georgia
Cash receipts from agriculture (millions $)	1,000	5,000	2,000
Percent of total land in agriculture	26	30	28
Decline in area of agricultural land since 1978 (percent)	19	20	19
Number of farms, all ownership classes (thousands)	41	35	40
Decrease in number of all farms since 1978 (percent)	19	7	22
Number of farms > 400 ha (thousands)	15	17	23
Number of (small farm) farms < 4 ha (thousands)	2	8	2
Change in number of small farms since 1978 (percent)	− 25	+25	− 18
Number of individually owned family farms (thousands)	39	29	35
Decrease in number of family farms since 1978 (percent)	18	8	25
Decline in farm area of family farms since 1978 (percent)	7	26	4

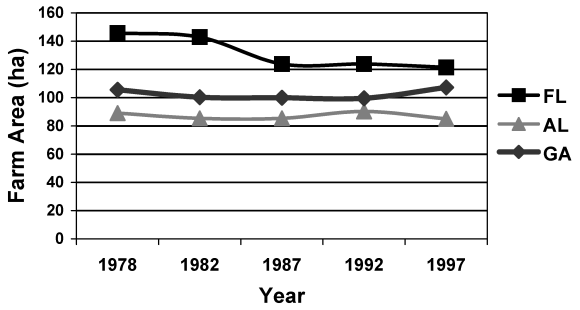

Figure 1. Mean number of hectares for farms of all ownership categories from 1978-1997 in the states of Alabama, Florida, and Georgia. Source: Data from NASS 2001

pastureland has diminished only slightly between 1987 and 1997. Alabama and Georgia have about 50% more farms with pasture than Florida; however, the area of pastureland in Florida is about twice that of the other two states (2.5 mil ha). Land area of woodland pasture represents 25% of the area under pasture in Georgia, 23% in Alabama, and 18% in Florida (NASS, 2001).

The average size of individual/family farms has decreased markedly in Florida (26%) during the 20-year period (1978-1997) but, similar to average farm size for all owners, comparatively little in Alabama and Georgia (4 to 7%). In Florida, in 1978, the family farm averaged 90 ha but the area decreased to 67 ha by 1997. Florida has almost four times as many small farms less than 4 ha (10 ac) than Alabama and Georgia (Table 1). The number of small farms in Florida has increased 25% since 1978 in contrast to a decrease in Alabama (25%) and Georgia (18%); the latter two states have just over 2000 small farms in each (NASS 2001).

During the period from 1978 to 1997, the average age of farm operators increased by 3 to 4 years (to approximately 55 years old in 1997) in all three states. There has been a decrease of about 40% in operators less than 34 years old while numbers of operators over 70 years of age increased by 20% in Alabama and 39% in Florida. Since 1987, the number of female farm operators increased from 17% to 33%, as has the number of hectares they farm. Between 40% and 50% of all farmers in all three states work off farm for more than 200 days per year. During this period, farm-operation costs have increased, and so have land prices (caused by development of non-farm enterprises), especially in coastal areas and south Florida, and rate of leasing land for food production has increased. The majority of farmland owners rely on off farm income to maintain their livelihood (NASS 2001).

Water quality and groundwater recharge are threatened by contamination from agrochemical sources and urban runoff throughout the region. In Georgia, the intensity of surface water use, especially during drought years, decreased flows, stressed aquatic life, and reduced groundwater recharge (GDNR 2002). Hyper-salinity in some near shore environments and salinization of water supplies in coastal areas are becoming more common. Increased pumping from groundwater wells has reduced stream flows and in some cases caused private wells to run dry in the lower Coastal Plain (GDNR 2002). Forest cover in bottomlands and gulf wetland areas, important components in regional hydrological systems, has suffered

Table 2. Agroforestry practices observed in the southeastern USA during CSTAF field activities, 2001

Alley Cropping	Pecans (*Carya illinoinensis* (Wangenh.) K.Koch) with hay and/or clover
	Pecans with peaches (*Prunus persica* (L.) Batsch) for first 10-12 years
	Vegetables in alleys during pecan or citrus establishment
	Ornamentals with blueberries (*Vaccinium corymbosum* L.)
	Fruit or nut (e.g., persimmon, *Diospyros virginiana* L., or chestnut, *Castenea dentata* (Marshall) Borkh.) with intercrop (e.g., vegetables or cut flowers)
Forest Farming	Pine straw; N & P fertilization increase straw
	Farmer to chef – herbs, mushrooms, specialty vegetables
	Growing edible and medicinal mushrooms (e.g., on melaleuca)
	Ferns under natural woodland (e.g., oak, *Quercus laurifolia* Michx.) shade
	Saw palmetto (*Serona repens* (W. Bartram) Small) management on native woodland range
	Ornamentals under shade trees
	Honey bees-(apiculture) and wildflowers grown for seed
	Native medicinals/botanicals grown under forest shade: mosses, Queen's delight, mints, mushrooms
Silvopasture	Bermuda (*Cynodon dactylon* (L.) Pers.) and bahia (*Paspalum notatum* Flüggé) mix with pines
	Winter grazing under pecans
	Poultry litter and manure application on trees/pasture
	Forage crops for cow/calf or fodder for confined operation
	Pastured poultry and free range with tree shade
	Fruit trees with animal pasture/hay
	Livestock-and − fruit for biogas on family farm
	Plant browse species along fence lines
	Cattle or Goats with scattered trees managed for shade
Special Applications	Shade for buildings, chicken houses and fish ponds
	Fruit trees combined with gardens, ponds and as bee forage
	Blackberries (*Rubus* spp.) for fruit, as live fence and wildlife habitat
	Fruit (e.g., citrus) under trees (e.g., live oak) for frost protection
	Cereal/mast species around tree plantations with fee hunting
	Planting and managing mast species for wildlife and human consumption (e.g., plums, *Prunus* spp., mayhaw, *Crategus aestivalis* (Walter) Torr.&A.Gray) and as field borders
Windbreak (line planting)	Border plantings for vineyards
	Around citrus or other orchards
	For protecting from frost
	Avocado, *Persea americana* Mill., for carambola, *Averrhoa carambola* L. (needs wind protection)
	Palms on bunds in flooded rice (field rotation with vegetables)
	Along lot lines increase assessed land value at sale
	As barriers against pesticide drift, odor, noise, dust, or roadsides
	Protection of animals from ocean winds and excess salt
Woody Riparian Buffers	Including shrubs and trees for wildlife use and bee forage
	Managed timber or short rotation woody crop
	Managed along streamsides and in farm drainage ravines
	Shrubs and trees with deeper roots to aid nutrient absorption
	Artificial wetlands/add woody buffer for animal waste lagoons (including fish ponds)

critical reduction. Only about 20% of the region's hardwoods in moist river bottom areas still stand (USDA 2001; Wear and Greis 2002).

Current agroforestry practices in the Southeast

CSTAF observations on current agroforestry practices in use during 2001 field visits and interviews across the Southeast are summarized in Table 2. These descriptive observations were used to verify material for the surveys in preparation at the time and provided specific vocabulary and examples for categorizing diversity of practices; unfortunately the extent of area under these practices, economic returns from them, and other system details are not yet known.

Professional survey respondents indicated wildlife habitat (mean = 4.2: scale of 1 to 5, where 1 is the lowest) and water quality (mean = 4.1) as the most important benefits of combining trees with crops or animals. Soil conservation was ranked as the third overall potential benefit with a significantly higher rank by professionals in Alabama and Georgia than

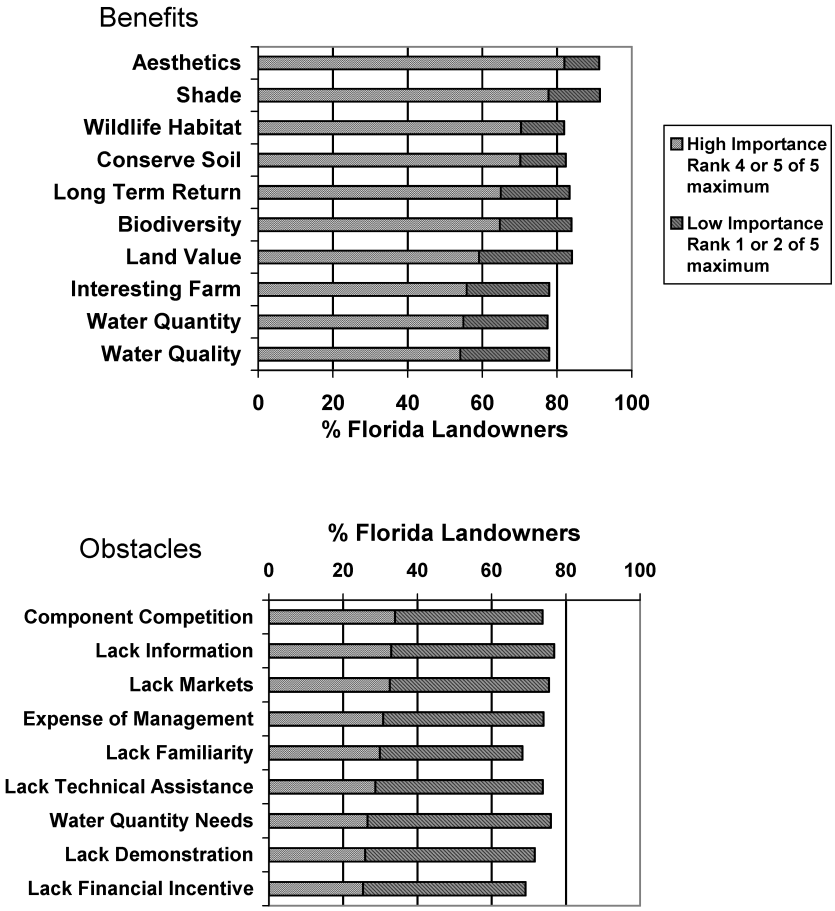

Figure 2. Benefits and obstacles of combining trees with crops or animals as ranked by Florida landowners (n = 160 to 183) during 2002 agroforestry opinion poll

Florida ($p = 0.05$). Influence on water quantity, long-term investment (mean 3.9 each), and aesthetics (mean = 3.8) had next highest benefit ranks in all three states.

Professionals responding to the opinion survey ranked lack of familiarity with the practices and the lack of demonstrations (mean 3.8 and 3.7) as major obstacles to use of agroforestry. The concern about lack of markets and lack of market information ranked next highest in importance (3.6 each). From 30% to 35% of the professionals in each state thought agroforestry had moderate to high potential in their work area. One-fourth of the respondents said they have programs that will support agroforestry and an additional 16% also indicated they were interested in learning more about agroforestry practices and developing programs for their clients.

Landowners in Florida and Alabama ranked benefits and constraints slightly differently from each other and in different order of importance than professionals. Given the same list of 16 potential benefits as the one given to extension professionals, Florida landowners ranked aesthetics (82%) and shade (72%) of highest importance followed by wildlife habitat (70%) and soil conservation (70%) (Figure 2). Alabama landowners rated wildlife habitat (74%), soil conservation (73%), aesthetic value (70%), increased land value (70%), shade (69%), and long term investment (68%) as benefits of highest importance. Neither set of landowners listed influence on water quality among the highest ranked benefits as was noted by extension professionals.

Wildlife habitat was among the top four potential benefits of agroforestry for extension professionals and landowners (ranked first by professionals and Alabama landowners). Both the extension professionals and the landowners also rated soil conservation high as a benefit. Shade was important to landowners

(second in Florida and fifth in Alabama) but was not ranked as highly by professionals. Aesthetics was ranked as the top benefit of agroforestry by Florida landowners and lower (third or sixth) by landowners in Alabama or professionals. Alabama landowners ranked increased land value as the fourth highest benefit whereas Florida landowners and professionals both ranked long term return as fifth. Both influence on water quality and water quantity were among the top four benefits ranked by professionals whereas landowners placed water issues lower on the importance list.

Alabama landowners rated obstacles to use of agroforestry as lack of equipment (25%), competition between trees, crops and animals (22%), lack of land area (20%), and lack of demonstrations (19%) as most important. Florida landowners rated competition between tree, crop and animal components (34%), lack of information about practices and lack markets (33% each), expense of management (31%), and lack of familiarity with practices (30%) as obstacles to agroforestry use (Figure 2). Competition between components was ranked first or second as a constraint by Florida and Alabama landowners but lower by professionals. All groups noted lack of familiarity, demonstrations and information as major obstacles to use of agroforestry practices. Lack of markets for products was also prominent among the major obstacles. As indicated by the results from Florida landowner responses, a higher percentage of landowners indicated the potential benefits of agroforestry were of greater importance than obstacles.

The majority of landowners responding to the survey indicated they were familiar with the definitions given for windbreaks (77%) and riparian buffers (78%), but were unfamiliar with alley cropping or intercropping (61% to 67%), forest farming (77%), nontimber forest products (67%), and patio or dooryard gardens (51%). When asked which of these they practiced on their land, landowners in both Alabama and Florida ranked riparian buffers, windbreaks and patio gardens of highest current use (Figure 3).

In Florida 48% of the landowners had patio gardens, 45% had windbreaks, 27% had riparian buffers, 26% had silvopasture practices, 14% practiced forest farming, and 14% cultivated an alley crop between trees. In Alabama, riparian buffers were the most widely practiced (52%), followed by windbreaks (43%), patio gardens (40%), forest farming (18%), silvopasture (16%), and alley cropping (12%) (Figure 3).

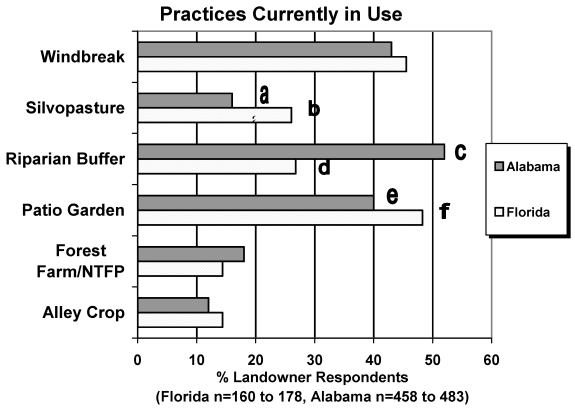

Figure 3. Agroforestry practices currently in use by Florida and Alabama landowners that responded to CSTAF opinion polls during 2002. In Florida, n = 160 to 178 and Alabama, n = 458 to 483. (a < b p = 0.004, c > d p = 0.0001, e < f p = 0.003)

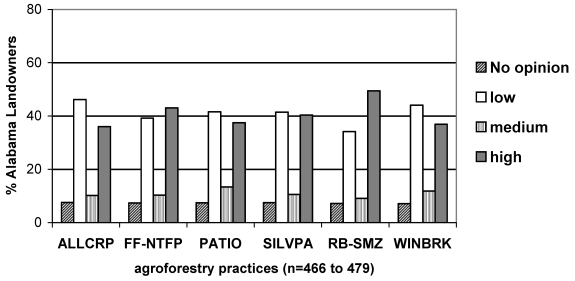

Figure 4. Alabama landowner rating of their interest to learn about alley cropping, forest farming and nontimber forest products, patio gardens, silvopasture, riparian buffers or streamside management zones, and windbreak technologies (CSTAF 2002 survey, n = 466 to 469). Practices: ALLCRP = alley cropping; FF-NTFP = forest farming and nontimber forest products; PATIO = patio or homegarden; SILVPA = silvopasture; RB-SMZ = riparian buffer or streamside management zone; WINBRK = windbreak

As an example of the extension potential for the practices (Figure 4), 49% of Alabama landowners are interested in learning more about riparian buffers and streamside management zones. The fact that over 40% are also interested in learning about forest farming/nontimber forest products and silvopasture —bodes well for potential adoption. Over one-third of the landowners are interested in obtaining information or in seeing all of the practices to learn if there is one that they will consider worth their time.

Discussion

According to results of the professional survey by Zinkhan and Mercer (1997), the reasons landowners are motivated to adopt agroforestry practices in the southern states rank in order from 1) improved 'on-farm economics' and economic gain, 2) multiple land use management and income diversification, 3) site suitability and erosion control, 4) shortened wait and increased regularity of income, to 5) support of conservation and environmental concerns. The perceived top environmental issues addressed by agroforestry were improved water quality, wildlife habitat, and erosion control.

Results from a survey by the USDA The National Association of Resource Conservation and Development (RC&D) Councils (NARC&DC 2000) noted the same top issues. The RC&D staff in Alabama, Florida, and Georgia, a small but select group, that responded to the survey indicated silvopasture, riparian buffers, and special agroforestry applications were the most widely observed practices in their work area. The issues addressed by their three most widely acknowledged agroforestry practices in these states echoed results from the earlier and larger survey by Zinkhan and Mercer, provided some greater detail about additional issues, and serve as a basis for comparison to CSTAF results with their peer group of forestry and extension professionals in the three states.

Issues previously described in the region that agroforestry addresses in the southeast (wildlife habitat, soil conservation, land value, and water quality), were confirmed by results of the surveys undertaken for this study. It is interesting to note, however, that the importance of perceived benefits differ between extension professionals and landowners. Aesthetics was ranked among the top three benefits of agroforestry by landowners in both Alabama and Florida, but lower by professionals. Professionals placed more emphasis on the potential impacts of agroforestry on water issues than landowners while, unlike landowners; the professionals may have taken shade for granted. Landowners also indicated high levels of use of windbreaks, something that was not widely recognized by extension professionals.

Education about component interactions may help landowners overcome their belief that a combination of crops or animals with trees necessarily means increased competition. The idea certainly has need of trial in the field and can be addressed by successful demonstration, research results, and supply of information to landowners. Farmers' markets and more direct marketing knowledge can help address the perceived lack of markets. Extension personnel and others are exploring avenues and means for linking producers with consumers in the region. Too, producers can learn more from the professionals as they broaden the diversity of their knowledge base, communicate with researchers and policy makers, and continue to investigate and value conservation incentives.

Potential for development of agroforestry in the southeastern U.S.

Alley cropping is practiced but not widely acknowledged or adopted. Many pecan orchard owners practice forms of alley cropping with management of cover crops or hay/grazing and some intercrop with horticultural crops in the early phase before nuts come into production (Bugg et al. 1991). Some citrus growers practice 'taungya' agroforestry by cultivating between young citrus seedlings for the first few years. There are others, though few, producing for farmers markets or interested in permaculture principles that have innovative designs combining fruit and nut trees or fruiting shrubs with horticultural or ornamental crops. Also, the growing demand for "nutriceuticals" (supplements designed to optimize nutrient benefits) and specialty crops, such as ethnic vegetables and herbs, may provide candidate crops for production in tree crop alleys. Alley cropping appears a good option for hillslope farming, orchards, or to diversify horticulture production. Unfortunately research results on the extent of area and productivity or other details of these practices are not published for the Southeast. Information on species combinations and operational guidelines for management also are needed.

The most widely recognized forest farming activity in the CSTAF survey was production of the nontimber forest product (NTFP) pinestraw. Beekeeping is also well established in the region though honey sales have suffered from greater regulation and hive parasites. There are operators producing decorative ferns, mushrooms and other cultivated plants under forest shade. The history of wildcrafting and use of medicinals, especially within specific cultural groups, provides an open door for development of forest farming practices in the region (Weigand 2002). We need to compile information of which shade tolerant

species and NTFPs have economic potential in the region, document their growth and management requirements, and determine market strategies with producers. It is also possible NTFPs can be managed on native range (Bennett and Hicklin 1998), or integrated into fence lines and riparian forest buffers. Of unique interest is the recognition of 'patio' or 'dooryard' gardens, especially in Florida, by professionals. A form of multistrata agroforestry commonly called homegardens, this practice has not been included in the set of temperate agroforestry practices acknowledged in North America. Popularity and practice of multistrata agroforestry likely reflects not only the subtropical climate of the region but also combines with the rich cultural diversity and display of practices brought to the States by people with heritage from the African, Asian, Caribbean and Latin American tropical areas. Which understory cropping practices are compatible with multistrata gardening or with timber stand improvement/management and what cultivars are available for use need to be addressed (AFTA 2000). The potential for development of NTFP enterprises holds promise not only for the three pilot states described in this report but also in adjacent subtropical zones of the Caribbean.

Riparian forest buffers are noted as the most widely used practice in the three states. Thanks to the USDA agencies and others in the region, there is information available about the benefits of riparian forest buffers or streamside management zones and a scientific basis for designing buffers to meet an expanding set of landowner and societal objectives (Lowrance R, pers. comm. 2002). Based on this available information, extension materials about design and placement criteria and how buffers can meet conservation and production objectives are being developed. All three states have recommended best management practices for streamside zones and there are government cost share programs in place to help promote maintenance and continued establishment of buffers and constructed wetlands (e.g., EQIP: Environmental Quality Inventive Program). We need further investigation and demonstration of viable species combinations and vegetation zonation to include short rotation woody species and specialty crops of value that have potential to increase buffer width and diversity. There is great potential to design decision support tools to help on-farm performance and selection of species.

Silvopasture practices are known to have economic benefits and addition of trees is a good option for existing pastures in the southeast (Clason and Sharrow 2000). Production of widely spaced rows of trees for timber, especially of pines, e.g., longleaf pine (*Pinus palustris* Mill.), in combination with the benefits of shade for animals offsets loss of pasture area and is attractive to a growing number of producers. Universities in Alabama and the USDA Natural Resources Conservation Service have initiated a network for silvopasture training and are leading the way with regional partners in establishment of demonstration sites in the Southeast. Possibilities exist for integration of browse species for both cattle and small ruminants into existing farm plans. Silvopasture technologies are applicable on a wide range of scale and are adaptable for small land holdings or small numbers of animals.

Special applications of agroforestry principles have been identified as promising activities in the region (NARC&DC 2000). Short rotation biomass, such as production of poplars (*Populus* spp.) can be promoted as a component for treatment for animal waste lagoons. Short rotation plantations could be sequentially cropped for hay or other inter-row crops in the first years after coppice. These and other trees can serve as visual screens or as barriers to decrease effects of odor, or noise around farmlands and urban interfaces. One of the most attractive applications may well be inclusion of woody plants on farms as landscape corridors for wildlife habitat and movement. These practices can help diminish the fragmentation of forest habitat, provide ecotones between land uses and increase aesthetic value of the area. As noted by Alabama landowners, these practices may also serve to enhance land value and valuation of property by prospective buyers.

Natural resource professionals in the region know windbreak and shelterbelt vocabulary, though few of them said they actively promoted use of the practice. During the interviews, many professionals did not perceive wind as a production problem in the region and those that did, horticultural agents in Florida, said producers use ryegrass (*Lolium perenne* L.) as a wind barrier. Looking around the landscape, there are many 'de facto' windbreaks along fence lines and property borders. Windbreaks and line plantings could be integrated easily into existing horticulture and animal production systems, e.g., orchards or vineyards for additional economic benefit (Brandle et al. 1992). It is possible to include marketable products (ornamentals, specialty products) into windbreaks or to manage them for wildlife and integrate them in fee hunting schemes. Too, they can be incorporated into

suburban and urban settings as part of edible landscapes, for wildlife plantings, refugia for diverse species, and to oppose land fragmentation effects. Lack of awareness of windbreaks in the landscape suggests that we have to educate professionals and landowners about windbreak technologies and how they can be used to increase incomes. This will necessitate formulation of management guidelines for circumstances prevalent in the region.

Not only did the design team for the CSTAF extension program learn through the surveys what knowledge and beliefs professionals have about agroforestry, but they also obtained perceptions of land use from a range of landowners in or adjacent to the geographic work areas of each professional. The group of landowners may, in fact, represent a broader clientele than the professionals have come in contact with through their discipline (i.e., livestock, forestry, horticulture) network of acquaintances. Through the survey, professionals told the design team what materials they have and indicated how agroforestry fits into effective extension of technical information. This broad land-user focus leads to increased communication about landowners to professionals. Combined with training events at the agricultural district level, this enhanced communication can provide professionals with relevant tools to address the socioeconomic and ecological interface where the landowner works. Thus a continuous learning process by design team, professional and landowner is promoted (Scoones and Thompson 1994; Sinclair and Walker 1999), which could lead to development of local agroforestry systems that incrementally integrate trees into the landscape in various niches over time.

Acknowledgements

This publication was in large part supported by U.S. Department of Agriculture, Cooperative State Research, Education, and Extension Service, Initiative for Future Agriculture and Food Systems (USDA/CSREES/IFAFS) grant number 00-52103-9702. The authors thank Matt Langholtz, Soumya Mohan, John Bellow, Andrés Velasquez, Kristina Stephan and especially Andrea Garcia for assistance with this work.

References

AFTA, Association for Temperate Agroforestry. 2000. Agroforestry in the United States. Association for Temperate Agroforestry, Columbia, MO, 38 p.

Bennett B.C. and Hicklin J.R. 1998. Uses of saw palmetto (*Serenoa repens*, Arecaceae) in Florida. Econ. Bot. 52(4): 381–393.

Birch T.W., Lewis D.G. and Kaiser F.H. 1982. The private forestland owners of the United States. USDA Forest Service Res. Bull. WO-1, Washington, DC, pp. 64.

Bliss J. 1991. Trickle-down of innovations: Diffusion or delusion? In: Solaiman G. and Hill W.A. (eds), *Using goats to manage forest vegetation:* A regional inquiry. Workshop Proceedings. Tuskegee University Agricultural Experiment Station, Tuskegee, AL, pp. 9–16.

Brandle J.R., Johnson B.B. and Akeson T. 1992. Field windbreaks: Are they economical? J. Prod. Agric. 5: 393–398.

Buck L.E. 1995. Agroforestry policy issues and research directions in the US and less developed countries: Insights and challenges from recent experience. Agrofor. Syst. 30: 57–73.

Bugg R.L., Sarrantonio M., Dutcher J.D. and Phatak S.C. 1991. Understory cover crops in pecan orchards: Possible management systems. Am. J. Altern. Agric. 6: 50–62.

Clason T.R. and Sharrow S.H. 2000. Silvopastoral practices. In: Garrett H.E., Rietveld W.J. and Fisher R.F. (eds), *North American Agroforestry: An integrated Science and Practice*. American Society of Agronomy, Inc. Madison WI USA, pp. 119–148.

Dillman D.A. 2000. Mail and Internet surveys: the tailored design method. 2nd ed. Wiley-Interscience, New York.

Dix M.E., Bishaw B., Workman S.W., Barnhart M.R., Klopfenstein N.B. and Dix A.M. 1999. Pest management in energy- and labor-intensive agroforestry systems. In: Buck L.E., Lassoie J.P. and Fernandes E.C.M. (eds), Agroforestry in Sustainable Agricultural Systems. CRC Press, Lewis Publishers, Boca Raton, FL, pp. 131–155.

Georgia Department of Natural Resources, Environmental Protection Division. (Accessed May 2002) Georgia's Environment: Decades of Change. http://www.state.ga.us/dnr/environ/.

Kurtz W.B. 2000. Economics and policy of agroforestry. In: Garrett H.E., Rietveld W.J. and Fisher R.F. (eds), North American Agroforestry: An integrated science and practice. American Soc. of Agronomy, Madison WI, pp. 321–360.

Lassoie J.P. and Buck L.E. 2000. Development of agroforestry as an integrated land use management strategy. In: Garrett H.E., Rietveld W.J. and Fisher R.F. (eds), *North American Agroforestry: An integrated Science and Practice*. American Society of Agronomy, Inc. Madison WI USA, pp. 1–29.

Merwin M. 1997. The Status, Opportunities, and Needs for Agroforestry in the United States. Association for Temperate Agroforestry (AFTA), Univ. Missouri, Columbia, MO, 37 p.

NASS, National Agricultural Statistics Service. (Accessed May 2001). Derived from 1997 data located at http://goveinfo.library.orst.edu/document/ag97/agcont.html or www.usda.gov/nass/aggraphs/landinfarms.htm.

NARC&DC, National Association of Resource Conservation & Development Councils. 2000. RC&D Survey of Agroforestry Practices. Spring, 2000. Washington, DC. Also available through USDA National Agroforestry Center, Lincoln, NE, 30 p.

Schultz R.C., Colletti J.P. and Faltonson R.R. 1995. Agroforestry opportunities for the United States of America. Agrofor. Syst. 31(2): 117–132.

Scoones I. and Thompson J. 1994. Knowledge, power and agriculture – towards a theoretical understanding. In: Scoones I. and Thompson J. (eds), Beyond Farmer First, Intermediate Technology Publications, London, p. 16.

Sinclair F.L. and Walker D.H. 1999. A utilitarian approach to the incorporation of local knowledge in agroforestry research and extension. In: Buck L.E., Lassoie J.P. and Fernandes E.C.M. (eds), *Agroforestry in Sustainable Agricultural Systems*. CRC Press, Lewis Publishers, Boca Raton, FL, pp. 245–275.

Stamps W.T., Woods T.W., Linit M.J. and Garrett H.E. 2002. Arthropod diversity in alley-cropped black walnut (*Juglans nigra* L.) stands in eastern Missouri, USA. Agrofor. Syst. 56(2): 167–175.

USFS, USDA Forest Service. (Accessed December 2001). Forest Inventory and Analysis (FIA). US Forest Service, Research and Development Division. http://www.srsfia.usfs.msstate.edu/tables.htm.

Wear D.N. and Greis J.G. 2002. Southern Forest Resource Assessment. USDA Forest Service in cooperation with the Environmental Protection Agency, U.S. Fish and Wildlife Service, Tennessee Valley Authority, Southern Group of State Foresters and Southern Association of Fish and Wildlife Agencies. September 2002 with summary report October 2002.

Weigand J. 2002. The Caribbean Basin: Florida, Puerto Rico, and the U.S. Virgin Islands. In Jones E.T., McLain R.J. and Weigand J. (eds), Nontimber Forest Products in the United States. University Press of Kansas, Lawrence, KS, pp. 75–80.

Williams P.A., Gordon A.M., Garrett H.E. and Buck L.E. 1997. Agroforestry in North America and its role in farming systems. In: Gordon A.M. and Newman S.M. (eds), *Temperate Agroforestry Systems*. CAB International, Wallingford, U.K, pp. 9–84.

Zinkhan F.C. and Mercer D.E. 1997. An assessment of agroforestry systems in the southern USA. Agrofor. Syst. 35: 303–321.